

Claims

- [c1] A method of making a corner cube retroreflective assembly, comprising the steps of: selecting a wafer of a single crystal material having a cubic crystal lattice structure with the facial surface of the wafer oriented in a {100} plane of the cubic structure; forming on the facial surface of the wafer a mask pattern of an ordered array of closely spaced substantially parallel rectangles aligned with the <110> direction of the crystal structure; etching the crystal material with an anisotropic etchant to form an array of V-grooves in the {111} plane of the cubic lattice structure; dicing the wafer to establish a plurality of individual corner cube elements; and placing three individual corner cube elements in relative position with one another to form a corner cube retroreflective assembly.
- [c2] The method of claim 1, in which the wafer is single crystal silicon.
- [c3] The method of claim 1, further comprising determining a crystal flat of the wafer.
- [c4] The method of claim 3, further comprising determining a crystal flat of the wafer utilizing a fan shaped mask.
- [c5] The method of claim 1, wherein nitride is utilized to form the mask on the substrate and potassium hydroxide solution is used to etch the crystal material.
- [c6] The method of claim 1, wherein oxide is utilized to form the mask on the substrate and tetra methyl ammonium hydroxide is used to etch the crystal material.
- [c7] The method of claim 1, further comprising prior to the step of dicing the wafer, bonding the array of V-grooves to a supporting wafer handle.
- [c8] The method of claim 1, wherein the step of dicing the wafer to establish a

plurality of individual corner cube elements, further comprises through wafer dicing utilizing deep reactive ion etching.

- [c9] The method of claim 1, wherein the step of dicing the wafer to establish a plurality of individual corner cube elements, further comprises single cut dicing utilizing a dicing saw.
- [c10] The method of claim 1, wherein the step of dicing the wafer to establish a plurality of individual corner cube elements, further comprises single cut dicing utilizing laser machining.
- [c11] The method of claim 1, wherein the positioning of the corner cube elements results in the intersection of three planes, each plane having an angle of about 54.74 degrees to the surface of the wafer.
- [c12] The method of claim 1, further comprising forming an electrostatically actuated cantilever on at least one of the three individual corner cube elements of the assembly.
- [c13] The method of claim 1, wherein the cantilever is substantially shaped as an isosceles triangle.
- [c14] The method of claim 1, further comprising the step of depositing a thin layer of metal on the mirror surface of the CCR.
- [c15] A corner cube retroreflector produced according to the process of claim 1.
- [c16] A method of making a corner cube reflective array, comprising the steps of:
selecting three wafers of a single crystal material having a cubic crystal lattice structure with the facial surface of each of the three wafers oriented in a {100} plane of the cubic structure; forming on the facial surface of each of the three wafers a mask pattern of an ordered array of closely spaced substantially

parallel rectangles aligned with the $\langle 110 \rangle$ direction of the crystal structure; etching the crystal material with an anisotropic etchant to form an array of V-grooves in the $\{111\}$ plane of the cubic lattice structure of each wafer; bonding a stabilization layer to the top side of each of the three wafers; etching the crystal material to remove the residual portions of the three wafers between the V-grooves, wherein etching is performed from the bottom side of the wafer, resulting in a plurality of individual corner cube elements bonded to the stabilization layer; bonding the bottom side of one of the three wafers to a final handle wafer; releasing the stabilization layer from the top side of one of the three wafers; positioning each of the three wafers to be at an angle of 120 degrees relative to each other; bonding the three wafers to provide an array of corner cube retroreflectors.

- [c17] The method of claim 16, wherein each of the three wafers vary slightly in thickness to insure that physical contact of the wafers takes place while bonding, without disturbing the prior bonded structures.
- [c18] The method of claim 16, in which each of the three wafers are single crystal silicon.
- [c19] The method of claim 16, further comprising determining a crystal flat of each of the three wafers.
- [c20] The method of claim 16, further comprising determining a crystal flat of each of the three wafers utilizing a fan shaped mask.
- [c21] The method of claim 16, wherein nitride is utilized to form the mask on the substrate and potassium hydroxide solution is used to etch the crystal material.
- [c22] The method of claim 16, wherein oxide is utilized to form the mask on the substrate and tetra methyl ammonium hydroxide is used to etch the crystal

material.

- [c23] The method of claim 16, wherein the positioning of the wafers results in the intersection of three planes, each plane having an angle of about 54.74 degrees to the surface of the array.
- [c24] The method of claim 16, further comprising forming an electrostatically actuated cantilever on at least one of the three wafers.
- [c25] The method of claim 24, wherein the cantilever is substantially shaped as an isosceles triangle.
- [c26] The method of claim 24, further comprising: laminating a dry film resist on top of the V-grooved wafer; patterning the resist and etching off the exposed PSG to form an anchor to the nitride layer; depositing doped poly silicon on top of the patterned PSG to form the cantilever; releasing the cantilever to provide a free cantilever.
- [c27] The method of claim 16, further comprising the step of depositing a thin layer of metal on the mirror surface of the corner cube retroreflector.
- [c28] A corner cube retroreflector produced according to the process of claim 16.